MaineDOT Fish Passage Policy and Design Guide: 2003 Annual Report

March 2004

Prepared by:

MaineDOT Fish Passage Steering Committee

Cover photo: Hosted by New Brunswick DOT and Canadian Department of Fisheries and Oceans: MaineDOT, Atlantic Salmon Commission, Department of Inland Fisheries Visit Coleman Brook Fishway Project (6/03). Photo by R. VanRiper.

Table of Contents

MaineDOT Fish Passage Policy and Design Guide
Second Annual Report: March 2004

History and Purpose

During the 1990s, Maine Department of Transportation's (MaineDOT's) two-year program expanded substantially to include more total miles of projects to be completed within the two-year funding cycle. Design technologies, environmental permit processing and construction requirements developed steadily. In addition, less expensive drainage repair strategies were developed that can change the flow and passage characteristics of a structure. Addressing all of these changes together during project development had increasingly become more complex and MaineDOT recognized that protocols were needed to consistently address fish passage in context with existing regulations and policies, interagency coordination, design practices, cost, and project schedules.

In 1999, MaineDOT convened and led a multiagency Fish Passage Work Group (Work Group), recognizing that consensus was necessary to address fish passage while producing better projects more efficiently. Cooperating agencies included:

- Maine Atlantic Salmon Commission
- Maine Department of Environmental Protection
- Maine Department of Inland Fisheries and Wildlife
- Maine Department of Marine Resources
- Maine Land Use Regulation Commission
- National Marine Fisheries Service
- Natural Resources Conservation Service
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service

To identify ways to reach this goal, the Work Group examined current regulations and policies, current practices in agency coordination, existing standards for fish passage, fish species likely to be present and their passage needs, and engineering design and construction considerations. After examining these items, the Work Group developed recommendations for installing and repairing water-crossing structures in a way that:

- Complied to the extent practicable with current state and federal regulations on fish passage (Maine Natural Resources Protection Act and Land Use Regulation Commission guidelines, Federal Endangered Species Act, Magnuson-Stevens Fishery Management Act, and Clean Water Act);
- Included clear protocol for nature and timing of agency coordination;
- Enabled the Department to make use of new and developing technologies such as slip lining, plastic pipes, concrete invert lining;
- Considered cost and other impacts;
- Reiterated MaineDOT's commitment to providing and coordinating fish passage; and
- Developed a base for biologic and hydrologic approaches to maintaining fish passage.

The outcome was MaineDOT's first Fish Passage Policy and Design Guide (Policy and Guide), released in March 2002 (MaineDOT, 2002). The document established a policy, process, and design guide with best management practices for fish passage and was specifically developed for MaineDOT projects with water-crossing structures. These structures include pipes or boxes of varying types and sizes, commonly referred to as bridges, struts, culverts, pipes or pipe arches (with or without footings), and can be part of any MaineDOT program. The document provides a framework, guidance and tools to process crossing projects by balancing a variety of natural resource and engineering parameters at any given site. It is a living document that guides MaineDOT staff and coordinating agency representatives to develop and implement effective fish passage that meets regulatory requirements and resource needs, while delivering safe, cost effective, and timely projects.

In April 2003, the first annual report was issued and reviewed with federal and state resource and regulatory agencies (MaineDOT, 2003). During 2003, MaineDOT used the policy and design guide to design and build fish passage measures. These experiences will help to improve our original document to add or retain effective strategies and discard those that were ineffective.

Accomplishments in 2003

STEERING COMMITTEE

The following Steering Committee is responsible for assuring the Policy and Guide is kept up-to-date; improving it as we learn more about passing fish by research, networking and our own experience; implementing; and sustaining the document's use by MaineDOT staff who assess, design, and construct fish passage. Over the past year, we have added a member to our steering committee from the Urban and Arterial Program. This should strengthen the connection between fish passage, that specific program and structural design.

Current Steering Committee Members:
Richard Bostwick, Chief Biologist/Agency Coordination
Charles Hebson, Chief Hydrologist
Michael Wight, Bridge Engineer
Brian Kittridge, Highway Designer
Robert VanRiper, Biologist
Peter Newkirk, Environmental Engineer
Sylvia Michaud, Chair/Policy

TRAINING

Photo by R. VanRiper, 6/03.

Our 2003 training included a 2 day visit to New Brunswick to talk with Transportation, Department of Fisheries and Oceans (DFO), and other natural resource officials while visiting several sites designed or retrofitted for fish passage according to DFO Guidelines (Savoie and Haché, 2002). Our many questions regarding design, construction, maintenance and effectiveness of fish passage measures were discussed. Our itinerary, a complete list of attendees and comments from several of the attendees are included as Appendix A. In addition to MaineDOT staff, representatives from the Atlantic Salmon Commission and Maine Department Fisheries and Wildlife attended this site inspection of constructed stream crossings. Some practices observed on this field tour were immediately put into use upon our return to Maine and will result in changes to our design guide for 2004. Participants had many positive comments. They felt the trip was very worthwhile and will continue to build our relationship with New Brunswick so we can learn from their many years of cutting edge work on fish passage.

POLICY AND GUIDE USE

We have continued to use the policy section of our document for project processing and technical assistance during design and construction, with good results. After meeting with New Brunswick officials, we have altered our approach to design, toward what we believe is a more sound and more predictable method. The 2004 Policy and Guide will endorse in-culvert pool-and-weir configurations as the preferred method for achieving adequate water depths in culverts when the normal pipe hydraulics is insufficient. This approach is based on the experience and success of transportation and resource agencies in Maritime Canada.

We have met with the Maine Department of Inland Fisheries and Wildlife once to review constructed fish passage projects (Fisheries and Hatcheries Divisions, 9/03) and once to discuss changes proposed for our Policy and Guide (Fisheries Division, 12/03). Our draft revisions will be presented to the multiagency Fish Passage Work Group for discussion before we finalize new measures.

USGS LOW-FLOW STUDY

In 2002 MaineDOT contracted with U.S. Geological Survey (USGS) to update the equations for estimating monthly flows on unregulated Maine rivers. This work was completed in 2003 and the report is in the final stages of the USGS review process. In the meantime, MaineDOT has received a draft copy of the monthly median flow equations and has already been using them in estimating flows for the design of fish passage in highway culverts. The revised equations utilize improved statistical methods and as much as 30 years of additional data at selected stations as compared to the earlier equations. These equations have improved the design process and provide a consistent, statistically sound method for estimating design flows. These equations, along with existing methods of field observations and site-specific characteristics, complete the toolbox for estimating fish passage design flow.

MONITORING

Site-specific monitoring is conducted at sites that have been retro-fitted for fish passage. Monitoring includes an initial inventory of habitat parameters before construction (baseline), followed by two years of post construction monitoring. Monitoring measures assess the efficacy of the technology we build to allow fish to pass through a structure by creating suitable conditions for passage. With commonly available measuring devices staff measure water depth, velocity, take photographs at specified locations, check for other physical barriers to passage, and assess overall

site conditions (stability, directly observing fish using structures to pass, etc.). If measurements imply fish passage is possible at the site, it is assumed that fish are passing during critical periods and that project commitments for fish passage have been met. Additional monitoring protocol is considered on a case-by-case basis and as cooperative efforts with other agencies. If, during or at conclusion of the monitoring period, any site appears impassable, MaineDOT will assess the problem and recommend remedial measures as appropriate, consulting with fisheries and regulatory agencies to resolve project issues.

CONSTRUCTED PROJECTS

Following are summaries from projects that have been constructed over the past three years. Location maps are included as Appendix B. The summaries have been edited to include basic information relating directly to this report. More information is available upon request.

Linneus, Bither Brook Bridge #3709, PIN 10049.00, Rte 2A over Bither Brook (2003)

Linneus: Log Drop Structure

Linneus: Looking down on Weir

Photos by M. Wight, 10/23/03.

Prior Condition: Existing 103' long 9' diameter steel pipe with 0.4% slope. Bottom of pipe heavily rusted with some holes. Inadequate water depth inside pipe during summer and 6" +/- drop at outlet.

Current Condition: Sliplined with 8' diameter aluminum pipe. Concrete weirs and baffles added inside pipe to insure adequate depth of water. Two log drop grade control structures ($2000 each) installed downstream to eliminate drop at outlet. Project completed 10/03 at total cost of about $157,000 including engineering.

Future action: Post construction monitoring to begin in 2004.

Lessons learned: Pending

Sebago, PIN 10802.00, Rte 11/114, Batchelder Brook (2003)

Sebago 2003. Photo by R. Hodgman.

Prior condition: Granite box culvert with outlet baffle sluice, not maintained and not effective. Invert elevation approximately 2' above normal high water mark of Sebago Lake. Meander in upstream channel of Batchelder Brook in contact with road, causing constant potential for erosion into brook. Proposed design - relocate portion of brook, install 4 log drop weirs (riffle-pool) to allow fish passage and as grade control for flows in shortened channel.

Current condition: New 9 ' diameter corrugated aluminum pipe, embedded (after removing ledge) 1' below normal high water mark of Sebago Lake. Final design substituted granite notch weirs for log drop structures to reuse material from demolition of granite box and reduce future maintenance needs. New culvert designed with 3% gradient. Slightly more ledge removed during construction than anticipated resulting in 2.5% gradient. New channel graded to match. Lower inlet invert required 2 additional weirs, for a total of 6 upstream. Riparian zone between new channel and roadway toe of slope revegetated with variety of plants for future channel shading. New channel currently stable after several rain events and high flows including a $Q^{1.5}$ event on 10/28/03. Channel evolving as sediment loads from upstream areas migrate through system, changing pool and riffle depths as channel moves towards equilibrium. Trout observed in new channel.

Future action: Monitoring over the next couple of years will include observation of channel evolution and potential for *salminoid* and/or adult smelt migration to upstream habitat.

Lessons learned: Pending

Wallagrass-Fort Kent, PIN 5220.10, Rte 11, Pinette Brook (2003)

Prior condition: Existing twin 36" pipes, 50' long. Needed replacing because too short and too small. Design of this section of road grade raised so longer pipe needed. Area reviewed for drainage needs and required larger cross pipe to meet modern standards.

Wallagrass/Fort Kent 2003. Photo by R. Annis.

Current condition: Installed new 7' x 40" structural pipe plate arch about 95' long with approximate 6-8" hang at outlet because of shallow ledge. Raised downstream pool elevation to match culvert elevation by installing weir of non-woven geotextile fabric and rip rap in downstream pool. Weir increased volume of water in pool and raised stream elevation at outlet of downstream pool sufficiently to pass fish. Some rip rap scoured and moved around within downstream pool exposing small area of geotextile fabric. Has not compromised structural integrity of weir.

Future action: Will continue to monitor site conditions to assure weir continues to function as intended and allows fish to pass.

Lessons learned: Use larger rip rap or install more permanent structure such as concrete Jersey barrier weir.

Carrabassett Valley, PIN 10803.00, Rte 16/27, Unnamed Tributary to Carrabassett River (2003)

Carrabassett Valley 2003. Photo by R. Hodgman.

Prior condition: 84" multiplate corrugated pipe. Pipe in poor condition with holes at and below waterline. 6" vertical drop at outlet. 60' upstream of confluence with S. Branch Carrabassett River, 2.1 miles N of Kingfield town line (adjacent to North bound end of MaineDOT Rest Area). Discharges in excess of $Q_{1.1}$ under hydrologic control of Carrabassett River (backwater condition). Substrates predominantly sand and pea-sized gravel upstream, hand to head-sized cobble downstream. Minor undercutting upstream. Two remnant and one active beaver dam upstream. No

fisheries identified by IFW regional staff. Site chosen as experimental location to expand brook trout habitat from Carrabasset River.

Current condition: Grouted plastic slip liner with smooth interior and downstream pool/weir. Flat-bottomed v-notch weir (6") constructed of 2 concrete (Jersey) barriers, connected by reinforced concrete, embedded 3' into stream bank above normal water line of stream and minimum of 2' into substrate. Stone channel protection and drop-pools downstream of weir outlet. Weir structurally sound, notch drop approximately equal to that at outlet. NW side of structure has settled approximately 1.5", allowing overtopping flow at moderate discharge levels. Downstream drop-pools in fair condition. During 2 post-construction site visits, rocks forming pools were relocated to improve pool configuration.

Future action: Two years of post construction monitoring.

Lessons learned: In coarse bed materials, bedding of structure with underwater fills may be necessary. Compacting bedding substrate should be standard procedure.

Lincolnville, Division 5, Rte 52, Unnamed inlet to Pitcher Pond (2003)

Prior condition: 60" round corrugated metal pipe 0.8 mi. S of Northport town line. Historic relocation of meander to cross perpendicular to roadway. Winter sand buildup and minor side slope failures. Down cutting created 18" vertical drop at structure outlet. Substrates up- and downstream variable, from pea-sized gravel to boulders. IFW identified excellent potential for foraging and reproducing brook trout migrating from Pitcher Pond. Recommendations: place new structure to better align with stream geometry, reduce vertical drop for suitable passage, shape upstream channel to fit with reach meanders, build resting pools for fish.

Current condition: New 72" round corrugated metal pipe placed at less than average gradient with invert elevation below existing streambed. Upstream channel machine graded to match vertical and horizontal stream geometries. Vertical and horizontal skewing better aligns new culvert with stream and partially dissipates outlet energy because vertical drop extends over longer distance in channel. Stone of various sizes used to stabilize upstream channel, relocated by hand to create low to moderate discharge channel. 6 resting pools excavated by hand. Discharge channel and resting pools stable. Relocating channel increased shading by mature softwoods upstream. Increased size and placement of stone weir materials intended to raise pool elevations and back water into pipe. Downstream pool outlet somewhat distorted (will be followed up and adjusted as necessary).

Future action: Will monitor channel stability and reestablished vegetation between new channel and toe of road shoulder. In summer 2004, stone at outlet of downstream pool will be checked and stabilized as needed.

Lessons learned: Currently, 2 privately owned culverts under a camp access road block downstream access for fish. If this blockage had been discovered before construction, it would have been considered in the decision of whether to provide fish passage at this site.

Belgrade, Division 4, Rte 135, Sanford Brook (2003)

Prior condition: Proposed slip lining of equalizer pipe.

Current condition: Slip line resulted in more than adequate depth of water with no velocity, allowing free passage.

Future action: No further action needed.

Bar Harbor, PIN 10056.00, Rte 3, Otter Creek (2002)

Prior condition: Existing culvert hanging approximately 10-12". To be invert lined with concrete.

Current condition: Miscommunication and use of an experimental, inadequate design resulted in unsuitable fish passage conditions. Culvert is lined, with 14 - 18" drop and drop outlet. Drop outlet is concrete sluiceway that has increased velocities in sluice and reduced water depth in culvert.

Future action: Current conditions are being looked at to determine what can be done to provide fish passage.

Lessons learned: Need to educate all stakeholders in process as to intent of projects. This project strategy was based on project in Blue Hill originally thought to work well but, after investigation, was deemed not to work. This and purpose of additional, proposed measures were likely not understood during design and construction.

Mount Vernon, Division 4, Belgrade Road, Unnamed tributary to Long Pond (2002)

Prior condition: 30" round corrugated metal pipe. 1.6 miles SW of Rome town line. Several ledge drops upstream creating alternating braided and drop/pool channel. 3' outlet drop over ledge and large woody debris. Stream bisects about 15' downstream around boulder. Downstream channel is riffle/pool with extensive bank undercutting and large woody debris downstream. Shallow ledge potentially limits lowering invert elevation without increasing slope of pipe. Per IFW, stream had historic resident population of brook trout. Several trout observed downstream. IFW recommended install new culvert at lower elevation and construct outlet grade control structures to alleviate downstream drop.

Current condition: New 36" round corrugated metal pipe. Blasted ledge to lower invert elevation as much as feasible. Upstream channel machine shaped to match existing. 6 stone drop pools constructed downstream to moderate existing 3' drop. Pool directly below outlet constructed of 14"+ diameter stone underlain by nonwoven geotextile. Geotextile anchored by stone, filled with bark mulch and cobble, and wrapped over base layer of stone. Layered stone over geotextile to anchor. Notched at downstream low point of pool. First pool backed water 30' into new pipe. Series of pools built within eastern portion of channel below outlet of first pool, formed in stone channel armoring. Geotextile placed over base layer of stone, anchored by additional stone and formed into rough pool configuration with 6" drops at each

outlet. Final shape of pools used mixture of bark mulch and cobble wrapped in fabric, with additional rock over. Area upstream of pipe has accumulated and lost material consistent with adjacent upstream reaches. Stream originates in large wetland, with limited storage so hydrographs during snowmelt and large precipitation events is fast and large flows have passed through pipe, gradually filling downstream pools (primarily those below larger, first pool). Volume and velocity of water during large events are very high and larger stones cannot be used for drop pools because of the small channel (average 3' wide).

Future action: Consulted with IFW, decided to retrofit with small concrete barriers, similar to Jersey barriers but only 4' long by 2' high. Expect to install summer 2004.

Lessons learned: Geotextile wrapped bark mulch and cobble was tried as a mass anchor, with more resistance to flow than individual rocks. Bark mulch in mix was an attempt to use natural materials to 'seal' downstream end of pools. The intent was when mulch became saturated, it would be more efficient at catching sediment. Although this may work in lesser gradient, lower volume streams, it did not perform here.

Belgrade, Division 4, Castle Island Road, Unnamed inlet to Long Pond (2002)

Prior condition: 4' round corrugated metal pipe, 1 mile west of State Rte 27. Substrates are small boulders mixed with hand to head sized cobbles. Riffle/pool. Vertical 6" drop at outlet. Resident brook trout population in stream. Culvert blocks use of potential habitat upstream.

Current condition: 40" smoothbore plastic slip liner. Slip liner placed at invert elevation. Constructed outlet pool to remediate outlet drop. Outlet pool control has washed out resulting in a 7" vertical drop.

Future action: Outlet pool needs to be replaced, possibly by concrete barrier with cut flat-bottom weir. MaineDOT will coordinate activities (already approved by IFW region B) and acquire NRPA Permit from Maine DEP.

Lessons learned: Boulder barrier was not effective as pool outlet control under conditions at this site.

Whitefield/Jefferson, PIN 10210.00, Rte 126, Unnamed feeder to Dyer Long Pond (2002)

Prior condition: Fish passage existed. Invert of pipe hanging 6" above pool. Downstream pool approximately 20' wide by 40' long with natural bottom and vegetated banks.

Current condition: Culvert extended 40 linear feet downstream. Excavated plunge pool of similar dimensions with limited riprap (only on downstream push-bar). Outlet to pool was left with existing cobble bottom and natural bank. Elevated pool outlet to culvert invert, improving passage. Banks of pool vegetated. Site inspected summer 2003 and functioning as designed. Re-vegetating nicely.

Future action: Continue to monitor stability of pool, especially after large storm events.

Lessons learned: Initial proposed outlet treatment was for a smaller riprap plunge-pool with riprap weir outlet. Lessons learned are: 1) riprap can be limited if pool is large enough to dissipate design flow in the pool; 2) riprap still required around culvert and on downstream push bar, but can be reduced on sides and at outlet if stream bed material is stable; 3) using this treatment can improve fish passage and accelerate improvement of habitat in pool.

Kenduskeag, Division 3 , Rte 15, Unnamed tributary to Kenduskeag Stream (2002)

Prior condition: Pipe was 4'x100' corrugated metal pipe proposed slip line. Pipe was about 20' under road and replacing pipe with available funds was not possible. MaineDOT proposed 42" x 102' slipliner. IFW agreed if fish could pass during most critical times. (Passage was not possible under prior condition.)

Current condition: Project construction went very well. Also installed small weirs throughout pipe to slow down water velocity and provide resting places. Monitored for past couple of years during passage times and times of high and low flow. Passage should be possible at times of migration based on monitored depth and flow velocity. During high flow and very low flows, passage isn't possible.

Future action: Final monitoring 2004.

Lessons learned: Slip lining a hanging pipe and providing passage at low flows is very difficult without additional measures to raise water levels.

Blue Hill, PIN 8955.00, Rte 172, Carlton Stream (2001)

Prior condition: Existing culvert hanging approximately 18" to be invert lined with concrete.

Current condition: During the invert line process, concrete sluiceway was installed at outlet end of existing culvert to allow fish to pass. One week after construction, beavers built extensive dam upstream. Beaver dam will probably prohibit any passage upstream of pipe.

Future action: None planned. May be monitored if/when beaver dam is abandoned or removed by others.

Lessons learned: Potential for beaver activity should be considered during planning/design. Sluiceway as installed may impede passage because of increased water velocity.

PROPOSED PROJECTS

Camden, Spring Brook Bridge, PIN 010128.00

This project is concrete box culvert rehabilitation. Existing concrete bottom slab will be raised by addition of new concrete. Fish passage concerns are lack of adequate

depth and hanging outlet. The possibility of adding weirs and a chute detail being considered. Construction scheduled for summer 2004.

Windham, Black Brook Bridge #6243, PIN 010171.00
(River Road over Black Brook)

Existing bridge is 10' diameter steel with heavily rusted bottom with some scattered holes in bottom plates. Passage concern is maintaining adequate depth of water for juvenile eels. Proposed project was concrete invert lining, which would raise invert elevation about 6". A hydraulic analysis was done to check depth at low flow. Analysis determined water depth was adequate to maintain passage of juvenile eels without using special measure such as weirs or baffles. Culvert invert lining project has been awarded and will be built in summer 2004.

Paris/Buckfield, PIN 10216.00
(Rte 117, Numerous unnamed stream crossings and Stony Brook)

This project is currently being designed. The original idea was to rehabilitate cross pipes, making sure that fish passage was provided. The condition of many of these streams (26 on the project) is high-gradient, high velocity, step pool mountain streams with perched outlets at crossings. The decision has been made to replace all pipes below stream grade, thereby maintaining effective passage. This project will be advertised and constructed in 2004 with no further action needed because none of the crossings will require special measures for fish passage.

Westbrook, Mill Brook Hill Bridge #5749, PIN 009031.00
(Austin Street over Mill Brook)

The existing bridge is two 10' diameter steel pipes. Bottom plates heavily rusted with many holes. Fish passage concern is small drop at outlet of pipes. Project is in final design phase and being designed as a replacement project using a concrete arch. Due to high associated utilities costs (over $500,000) for replacement project, culvert rehabilitation with weirs being re-investigated. Construction tentatively scheduled for summer 2004.

Marion, Cathance Bridge #2139, PIN 010065.00

(Route 86 over Cathance Stream)

Existing bridge being replaced with longer 24’ span by 9’ rise precast concrete arch on concrete footings on ledge. Maintaining minimum flow depths is main concern at this site. Steeppass (owned by others) located in a side channel just downstream from bridge. Adding weirs and possible channel modifications being investigated. Design will provide adequate water at steeppass, which needs repair to function properly (being investigated with others). Construction tentatively scheduled for summer 2004.

Eddington, Grant Bridge # 5414, PIN 011094.00

(Route 178 over Meadow Brook)

The existing bridge is single 17'-0" span by 11'-2" rise by 96' long steel structural plate pipe arch built in 1975. Pipe arch is in poor condition with heavily rusted bottom plates and some holes through the bottom plates. Pipe arch had inadequate water depth inside during summer and 1' +/- drop at outlet. Proposed project is concrete invert lining with six (6) additional concrete weirs. Five (5) weirs will be

constructed inside downstream end of pipe arch to form series of 6' by 6' pools. Remaining weir will be located inside pipe. No weirs or grade control structures will be used outside pipe arch. Construction scheduled for summer 2005.

Fairfield, Fish Brook Bridge # 6218 PIN 011098.00

(Route 104/139 over Fish Brook)

Existing bridge is 12' diameter steel pipe with heavily rust bottom. Pipe has drop at outlet. Proposed project is concrete invert lining with possible addition of downstream and/or in-pipe weir(s). Construction scheduled for summer 2005.

Embden, Baron Brook Bridge #5536, PIN 011097.00

(West Shore Road over Baron Brook)

The existing bridge is 10' diameter steel pipe with heavily rusted bottom and some holes in bottom plates. Fish passage is concern due to inadequate depth of water, high velocities and drop at outlet. Replacement and concrete invert lining being investigated. Concrete invert lining option will require some weirs to be added. Construction tentatively scheduled for summer 2006.

STATUS ON OTHER PROJECTS IN 2002 YEAR-END REPORT

Herseytown - postponed
Waldo - Unnamed tributary to Passagassawaukeag River, Route 131. Being designed as replacement instead of originally proposed rehabilitation. Passage will be incorporated into new design. No further tracking needed because no special measures installed for fish passage.

RELATED ACTIVITIES

MaineDOT's Erosion and Sediment Control Manual (BMP Manual)
The BMP Manual revision is in progress. The scope is to address temporary soil erosion and sedimentation control. The revised version of the manual will include revisions to address fish passage based on the Policy and Guide. Appropriate sections of the BMP Manual related to agency coordination and construction practices such as stream diversions, culvert outlet protection, in stream work, stream habitat protection and enhancement, and specific practices from the document such as pipe embedment guidelines, will refer to the Policy and Guide for recommended practices.

Expectations Through Early 2005

1) The Steering Committee will continue to develop and test new measures to improve how we maintain and restore fish passage. Specifically, we are seeking low maintenance measures that do not need to be adjusted seasonally or with changes in flow volumes. We will add successful measures to our Policy and Guide as we verify them. We are also preparing a substantially revised design guide that will be ready for use in 2004.

2) The 2004 version of the Design Guide includes detailed computational procedures for correctly sizing weirs. As MDOT develops more experience with the hydrology and hydraulics of pool-and-weir fish passage measures, we will develop simple look-up

tables and charts to augment the design computational procedures. The eventual goal is a look-up procedure where weir size is a tabulated function of watershed area and a few other design parameters. The more detailed and comprehensive methods will always be available for particular situations that are not consistent with the simplifications and assumptions of the look-up method.

3) We will continue to monitor constructed sites for two years and complete preconstruction baseline monitoring for those projects that will be constructed in 2004.

4) Our BMP Manual for erosion and sediment control (currently being revised) will reflect practices in our Policy and Guide and cite the document as a resource. We will include references to our Policy and Guide and other appropriate MaineDOT manuals and publications.

5) We will continue to monitor sites and compile data into our database for future reporting and in-house review of sites. We will continue to coordinate with Maintenance and Operations to link our database to the maintenance inventory so each specific structure can be easily accessible.

6) We will examine inspection protocol to involve more staff people and share information with others in the Department to increase the understanding of new technologies and their appropriate uses.

7) We will look for ways to share our practices and policy with towns and others outside MaineDOT who could benefit from our work by learning about it and adopting appropriate practices for their own work.

8) We will follow the 2004 season with an assessment report to agencies in spring 2005, which will include status of our efforts and our process at that time.

Conclusions

With the delivery of this report, we believe we have met all our commitments for 2003 as listed in the original Policy and Guide. We welcome any questions or comments on this report. Please direct them to Sylvia Michaud at sylvia.michaud@maine.gov or (207)624-3097.

Literature Cited

Maine Department of Transportation. 2002. Maine Department of Transportation Fish Passage Policy and Design Guide. Augusta, Maine.

MaineDOT Fish Passage Steering Committee. 2003. MaineDOT Fish Passage Policy and Design Guide: First Annual Report. Augusta, Maine.

Savoie, R. and D. Haché. 2002. Design Criteria for Fish Passage in New or Retrofit Culverts in the Maritime Provinces, Canada (Draft). Department of Fisheries and Oceans. Moncton, New Brunswick, Canada.

APPENDIX A

New Brunswick Site Inspections
Attendees
Comments
Itinerary

Attendees For Fish Passage Site Inspections
June 10 to 12, 2003

MaineDOT:
Bridge: Lynn Cornfield, Mike Wight
Urban and Arterial: Brian Kittridge
Locally Administered Projects: Bob Raymond
Regional: Aaron Eaton, Ryan Hodgman, Rich Crawford
Environmental: Richard Bostwick, Deane VanDusen, Bret Poi, Charlie Hebson, Bob VanRiper, Ryan Annis, Sylvia Michaud

Maine Department of Inland Fisheries and Wildlife: Bill Woodward

Atlantic Salmon Commission: Norm Dube

Some Comments from Attendees

"I thought (our hosts) did an outstanding job on developing the tour and showing us the various structures and the evolution in form and function. They were very attentive in making sure our questions were answered and we had all of the information on structures being presented." (Deane Van Dusen - MaineDOT Mitigation Program)

"In many of our Maine applications for smaller culvert design at specific sites all may incorporate some aspect of the New Brunswick design, but may also use what we have in our design guide... it was an eye opener to see their design (which is pretty close to our design guide) in use and get feedback from the engineers and biologists on the jobs to hear what they have experienced." (Bill Woodward - Maine Department Inland Fisheries and Wildlife)

"The in structure weir system eliminates any concerns for keeping a minimum depth or flow and could mitigate for a flat bottomed structure... if we could get a protocol in place... we can make passage routine rather than having each passage project be a special occasion." (Richard Bostwick - MaineDOT Field Studies Program)

"If I learned anything on the trip, then this site meets all the criteria to use weirs downstream...with some design within the culvert as well." (In reference to a site in Maine visited a few days after the field tour by Bill Woodward)

"Consider not using grade control structures made from logs. Logs do not last long." (Mike Wight - MaineDOT Bridge Program)

"From the Regional perspective, we think we could used to precast pipe with the weirs cast with the pipe... I also like the weirs incorporated in with the invert relining. The additional costs of the weirs are minimal. One thing we saw was the downstream weirs made with jersey barriers... I think this is a great approach and low-cost." (Rich Crawford - MaineDOT Regional Program

"The primary value the trip was that all now have seen some actual applications in place and working." (Bob VanRiper - MaineDOT Field Studies Program)

ITINERARY [1]

NBDOT Culvert Structures Designed or Repaired to DFO Fish Passage Guidelines
Co-operative Site Inspection with Maine.
June 11 & 12, 2003

Start Location = St. Stephen, NB

1) Un-named tributary to Oak Bay - 2100 mm conc. pipe on 6.37% slope c/w fish passage weirs thru-out 137.5 m length - four lane highway, not open, built 1997.
2) Gallop Stream No. 2.5 - 6100X3050 mm SPCSP arch on concrete footings c/w fish passage weirs thru-out and downstream - about 2 km east of (1), built 1998.
3) Un-named tributary to Gallop Stream - 3048X1829 mm concrete box culvert c/w with fish passage weirs thru-out 130 m length, also outlet pool. About ¾ km east of (2), built 1998.
4) Bonaparte Lake Outlet - 3240 mm SPCSP rehabilitated with concrete invert and fish passage weirs in pipe and downstream. Located on Route 1. Built 1999.
5) Mazerolle Settlement Road Interchange - New four lane highway has separated 2400 mm concrete pipes, fish passage thru-out, median channel construction and conservation planting of alders. Built 1996.
6) Meransey Brook No. 1 - Whitetail Road near Tracy, N.B. 2001 rehabilitated 6850X5100 mm SPCSP (pipe-arch) has fish passage weirs thru-out 33460mm length and down stream, utilizing concrete median barriers.

Overnight in Fredericton

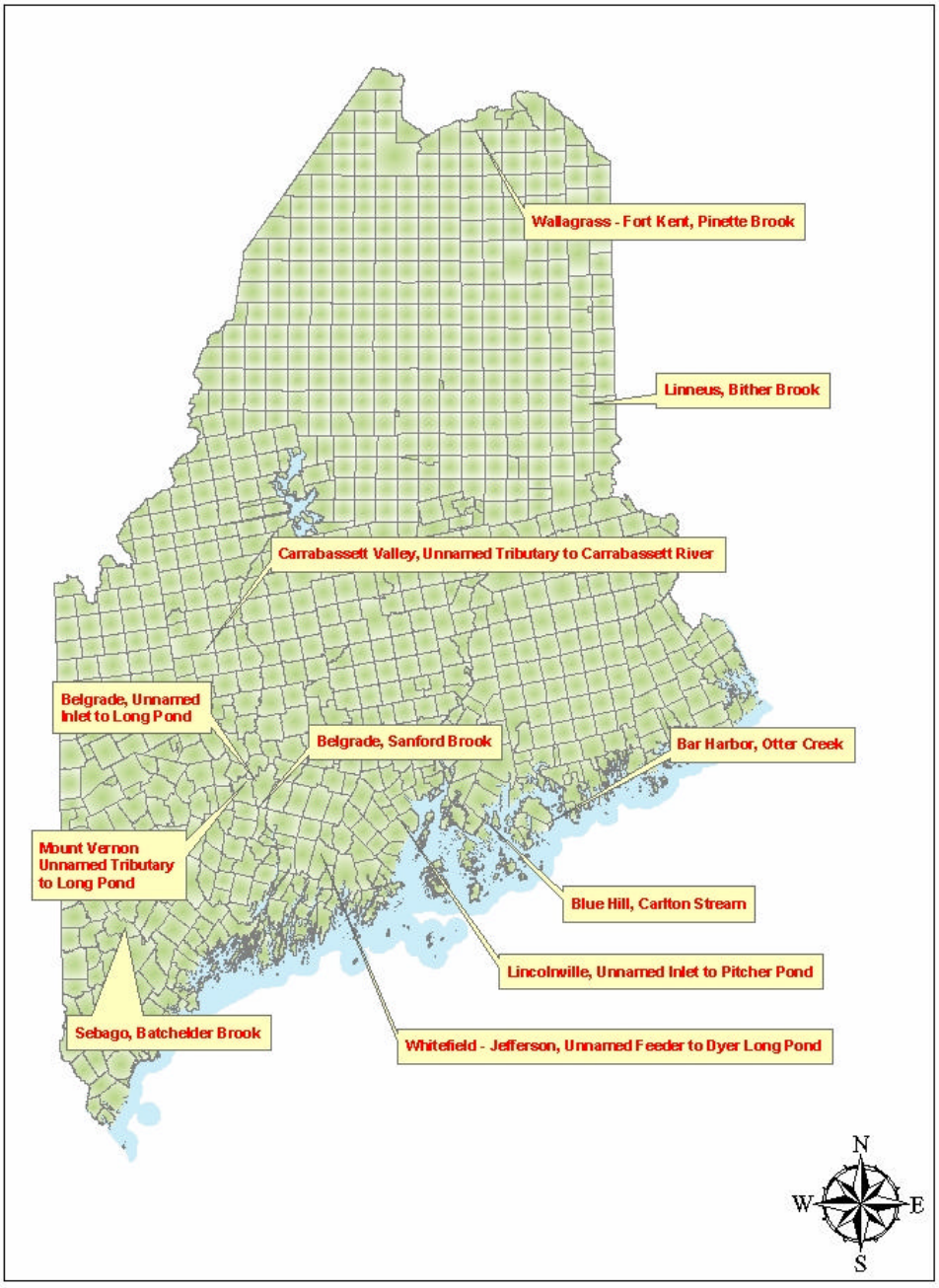
7) Rockwell Stream No. 2 - possible construction site where twin 4270 mm SPCSP Pipes are to be rehabilitated c/w concrete inverts, fish passage weirs thru-out and Downstream weirs in channel. Depends on Contractor start date. Route 7.
8) River George - Twin SPCSP arches (3960X2060 mm) on concrete footing/floor system c/w fish passage weirs thru-out 79400 mm length, outlet pool. On Route 7, about 21 km south of (7). Built 1992.
9) Coleman Brook - 50000 mm long SPCSP pipe (3050 mm diameter) that was rehabilitated with a concrete invert, fish passage weirs and a cast-in-place, six pool concrete fishway at the outlet. Route 7, about 12 km south of (8). Built 1999.
10) Perch Brook No. 2 - Prince of Wales access Road about 11 km west of Route 7 - Route 1 interchange. SPCSP pipe, 3660 mm diameter, 69600 mm long, designed with concrete fish passage weirs and outlet pool. Built 1994.
11) Hanson Stream No. 1.5 and No. 2 - Concrete Box culverts c/w fish passage weirs Thru-out both structures, connecting median channel c/w rock weirs and extensive rip-rap. Divided 4 - lane Route 1, about 10 km west of (10). Built 1991.

[1] This itinerary was developed by NBDOT and measurements have intentionally been left in metric units.

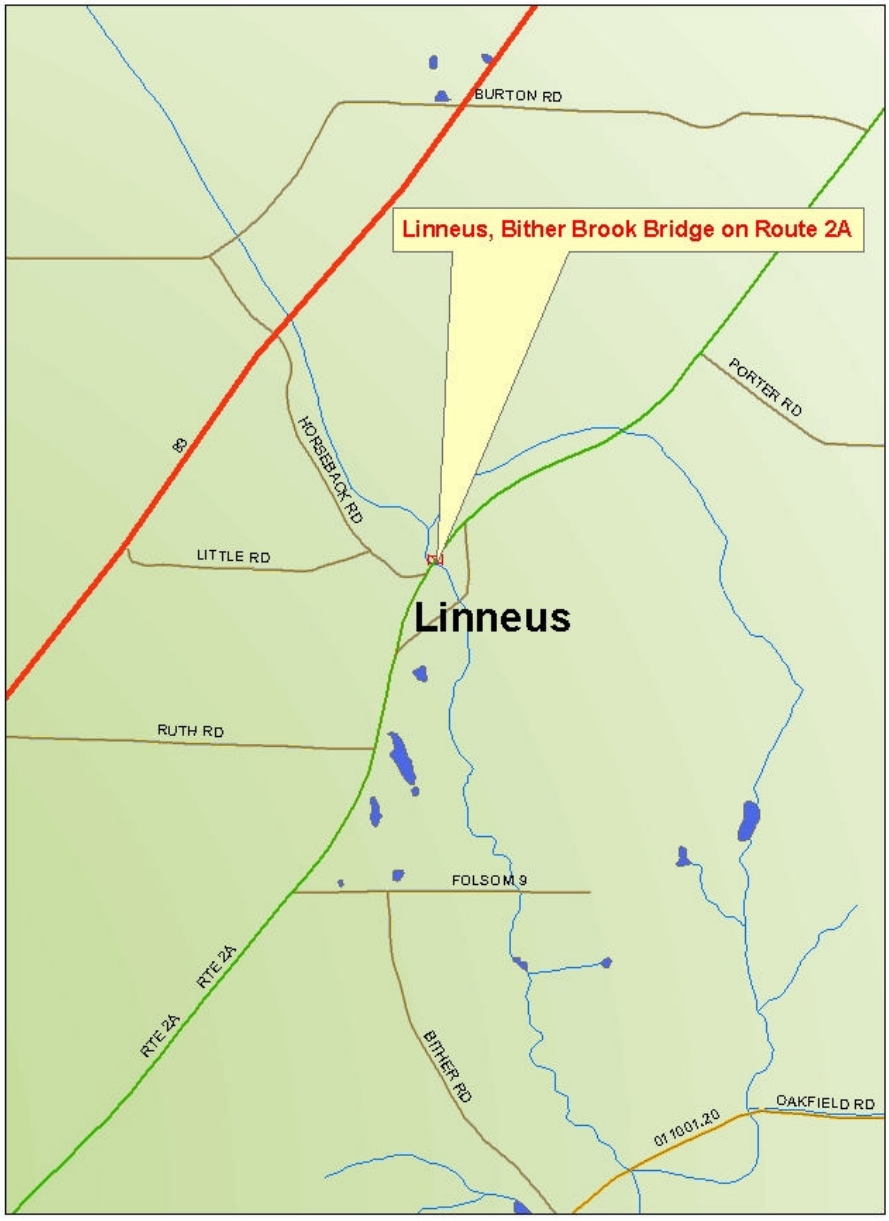
APPENDIX B

Location Maps for MaineDOT Constructed Fish Passage Sites

MaineDOT Fish Passage Sites

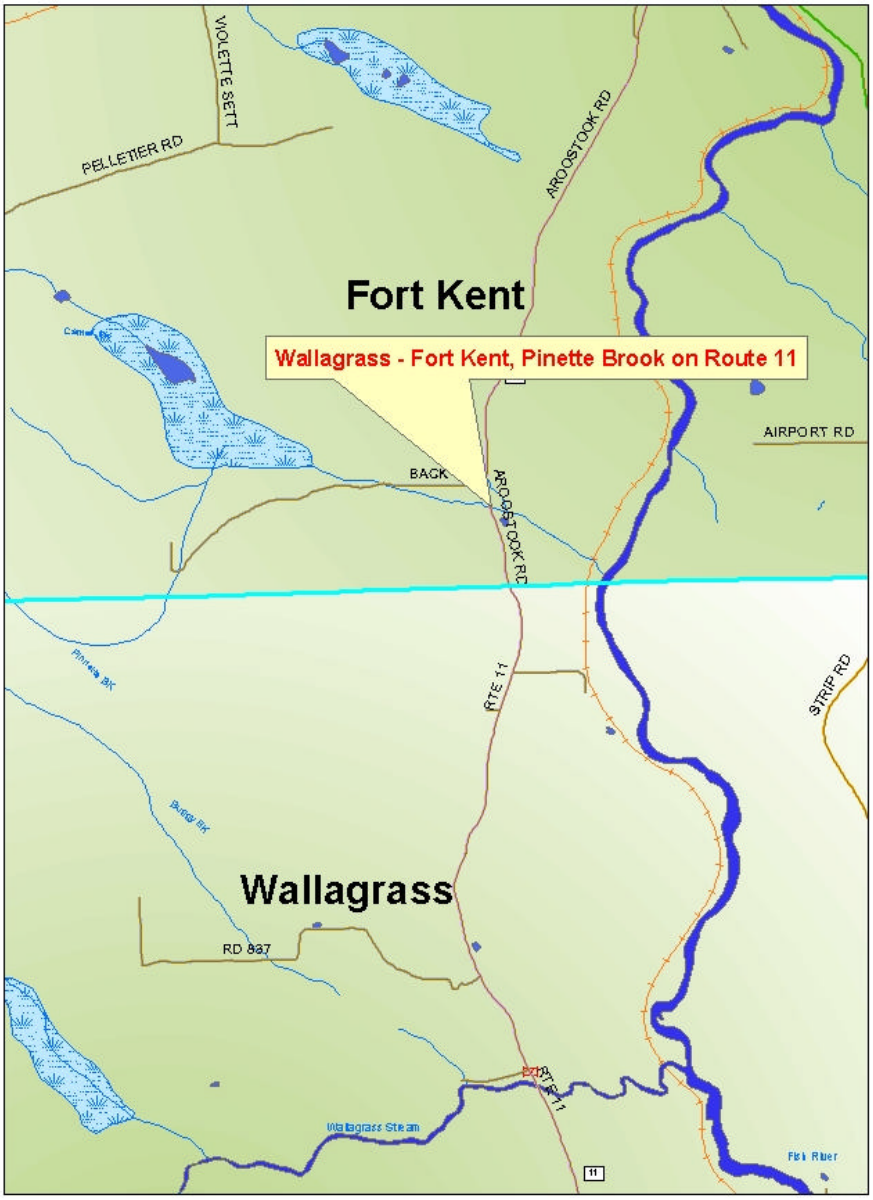


Linneus, Bither Brook Bridge

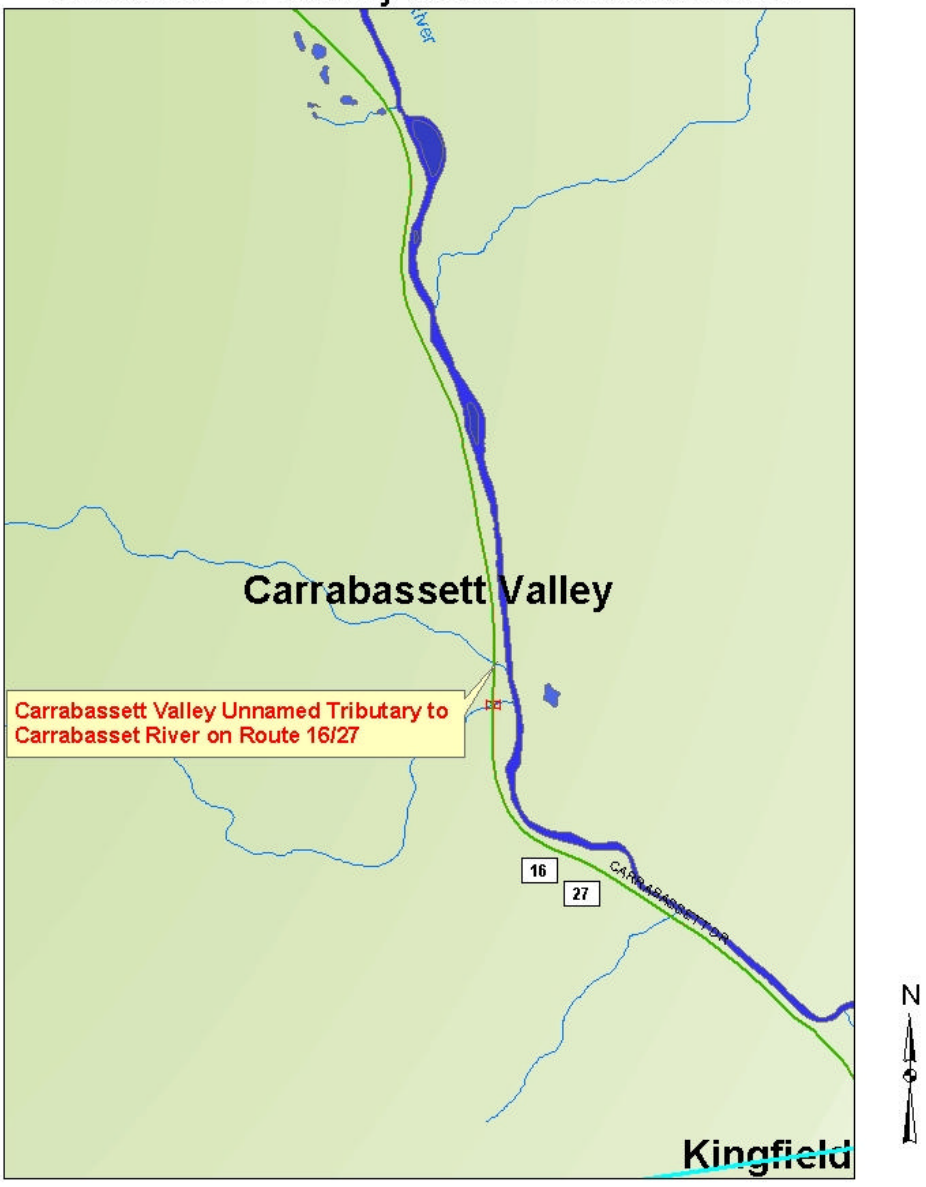


Sebago, Batchelder Brook Route 11/114

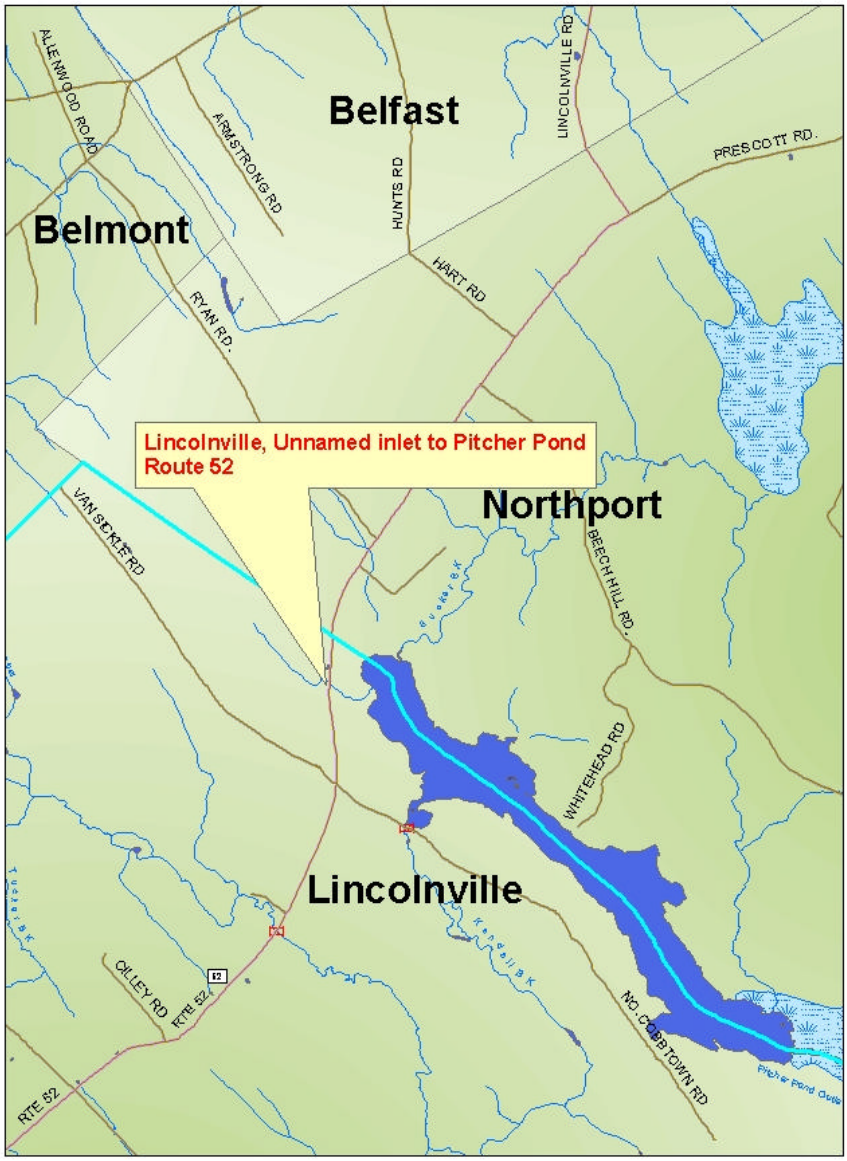
Wallagrass - Fort Kent, Pinette Brook



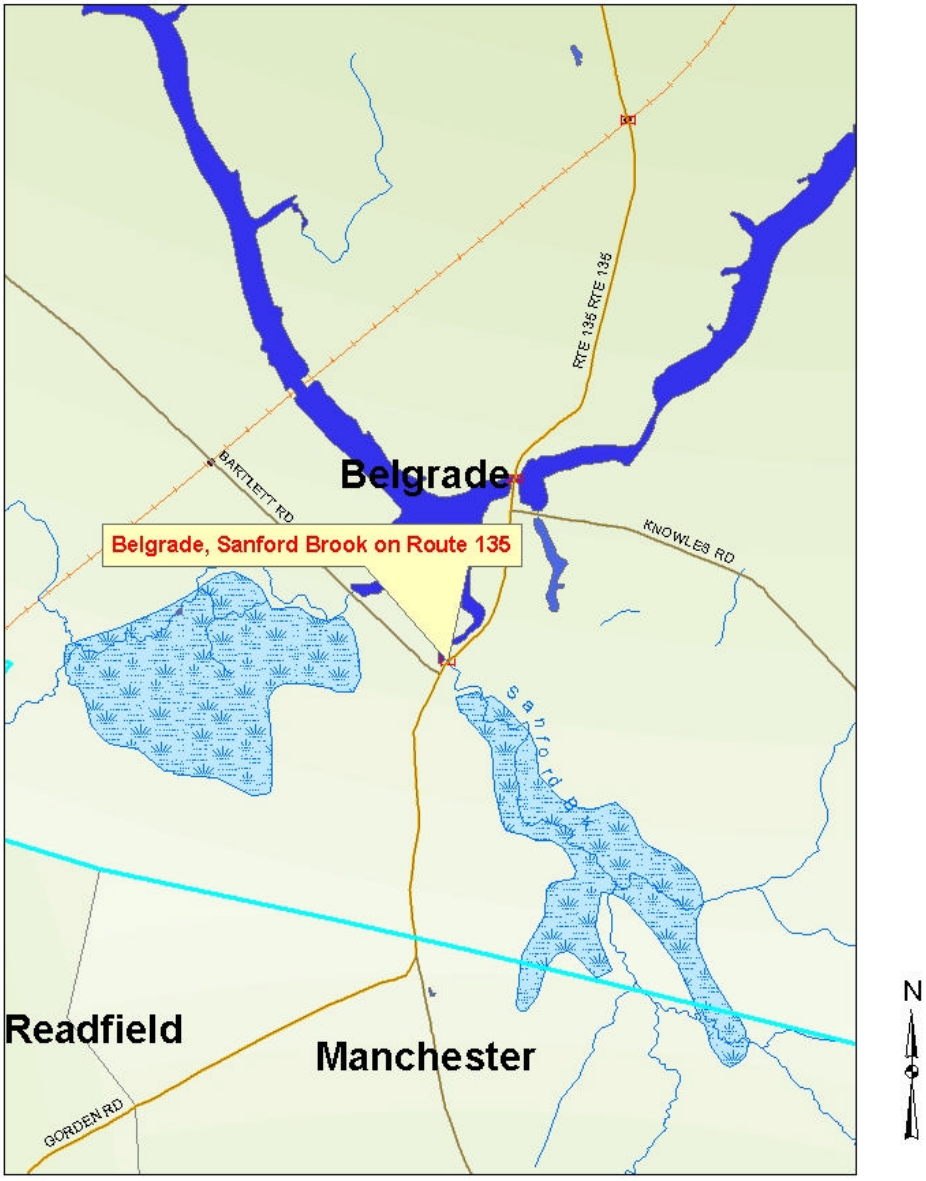
Carrabassett Valley
Unnamed Tributary to Carrabassett River



Lincolnville, Unnamed inlet to Picher Pond

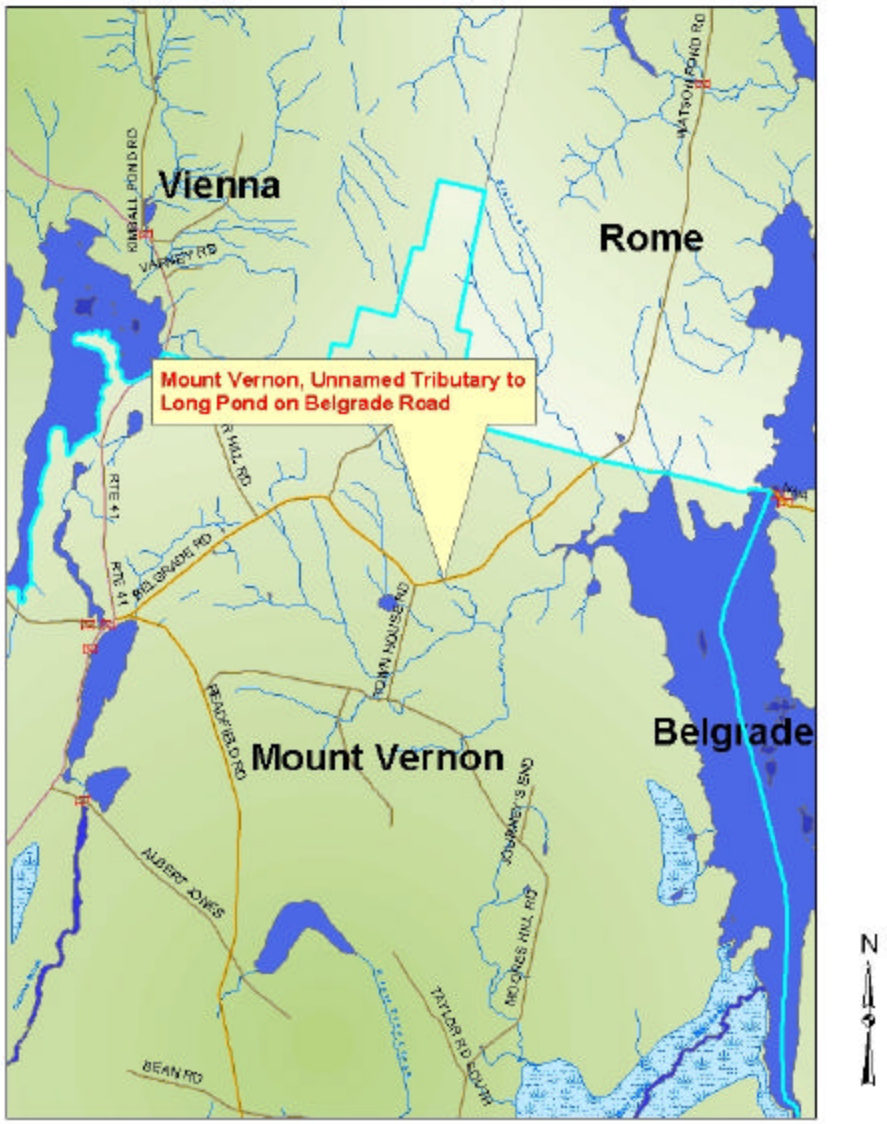


Belgrade, Sanford Brook

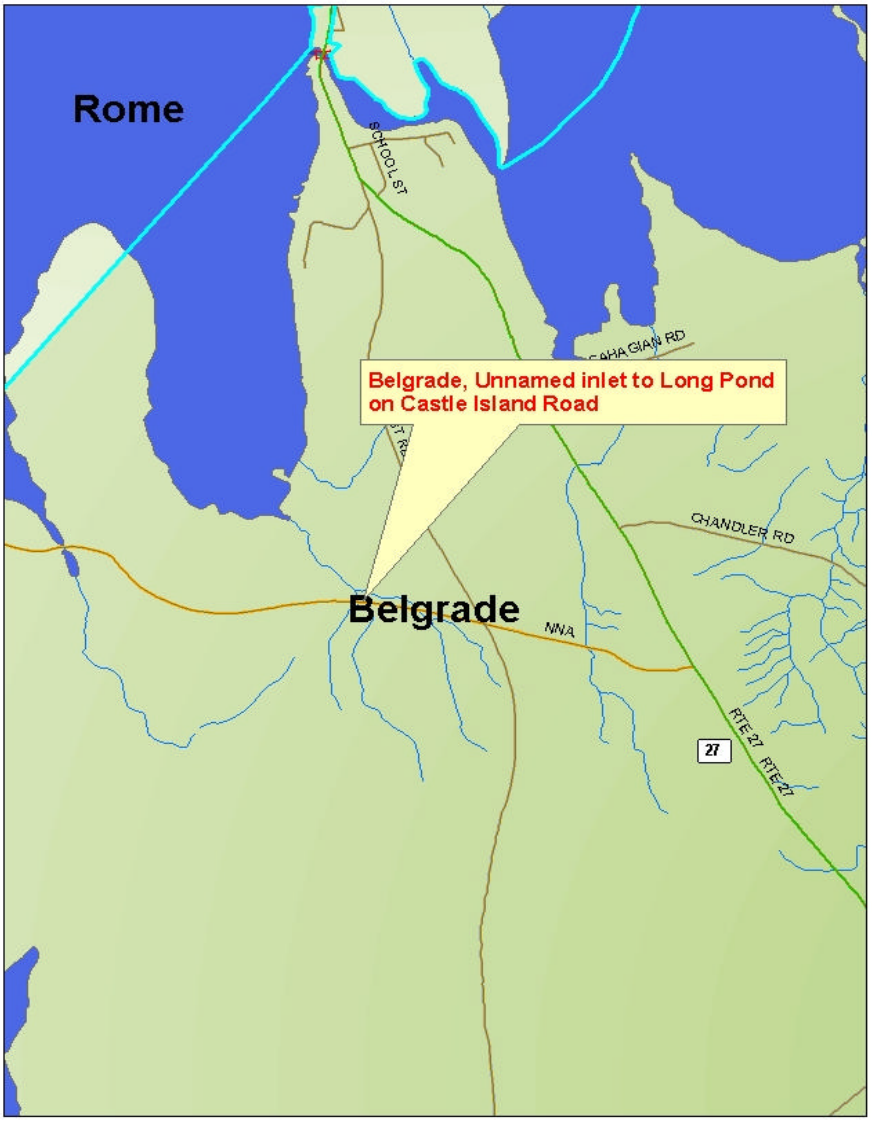


Bar Harbor, Otter Creek

Mount Vernon, Unnamed Tributary to Long Pond

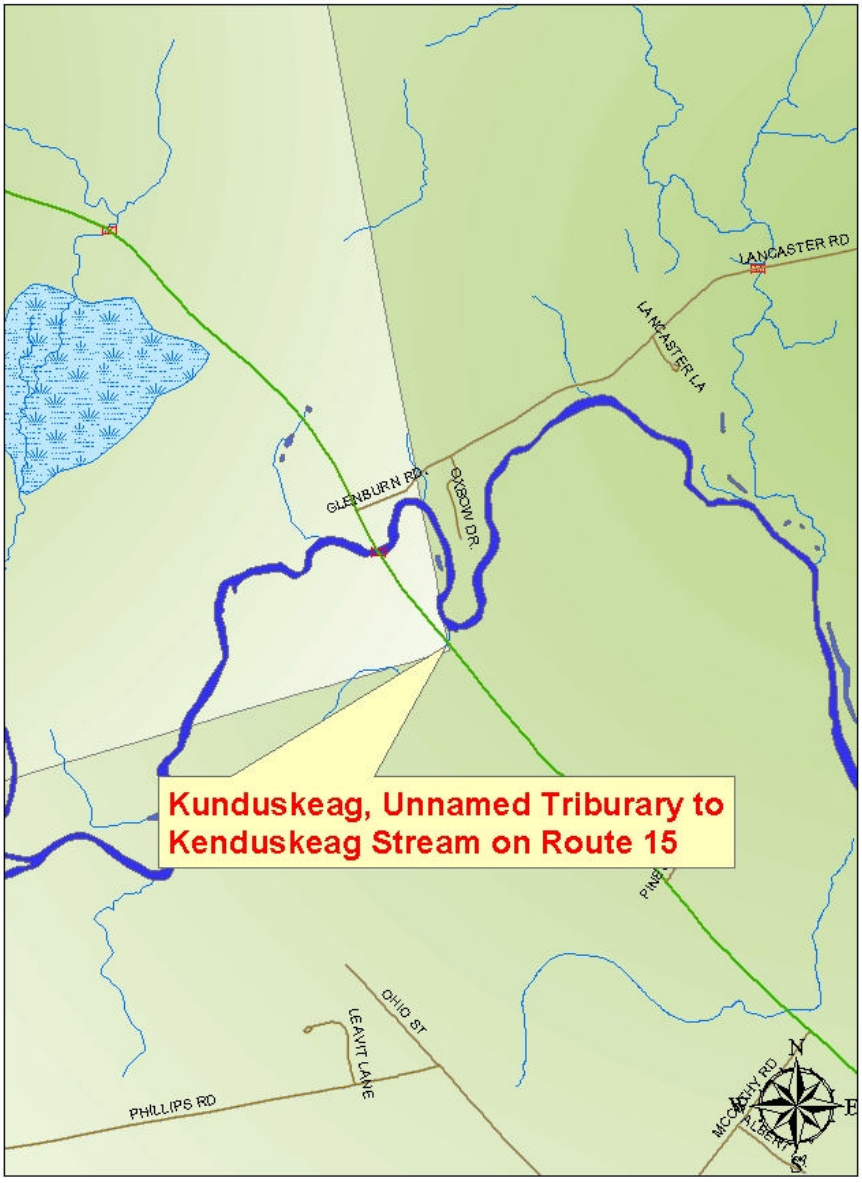


Belgrade, Unnamed Inlet to Long Pond



Whitefield/Jefferson, Unnamed Feeder to Dyer Long Pond

Kenduskeag, Unnamed Tributary to Kenduskeag Stream



Blue Hill, Carlton Stream